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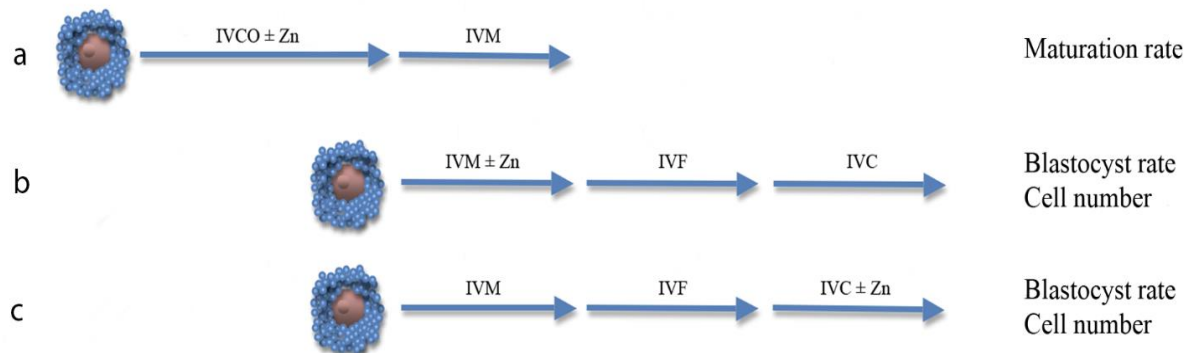
Study on the effects of zinc supplementation during in vitro embryo production technologies in cattle.

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Modern farming is increasingly relying on in vitro embryo production (IVP). However, in vitro culture systems are not yet capable to fully support oocyte and early embryonic development. Recent studies in mice have revealed the importance of zinc in regulating oogenesis and early embryogenesis (Bernhardt et al. 2012; Tian & Diaz, 2013). Moreover, zinc transporters are differentially expressed in different cell types throughout several steps of oogenesis and embryogenesis in cattle (Dieci et al. 2016; <http://emb-bioinfo.fsaa.ulaval.ca/IMAGE/>). Nevertheless, zinc modulation during culture of oocytes and early embryos has not been yet implemented in cattle. Thus, we assessed whether zinc is one of the essential players in the process of bovine oocyte competence acquisition and embryo quality by supplementing with 0.01-25 µg/mL of zinc the media used to 1) culture growing oocytes collected from small antral follicle, 2) mature fully-grown oocytes collected from middle-size antral follicles and 3) culture in vitro produced zygotes (Figure 1). Oocytes cultured under standard conditions served as control group. Zinc supplementation during 24 hours of oocytes in vitro growth significantly improved the proportion of oocytes reaching the metaphase-II stage of meiosis after subsequent standard in vitro maturation (IVM; 41.53±5.51 vs 57.79±4.32; P<0.05 oneway-ANOVA). On the contrary supplementation of IVM or embryo culture media had no effects on blastocysts rates and embryo quality, as assessed by cell number per embryo. In conclusion, zinc supplementation can greatly improve the exploitation of the ovarian reserve since it increases the meiotic competence of growing oocytes, which are usually discarded in standard IVP settings. These results are in accordance with in vivo studies in mouse, showing the detrimental effects of zinc deficiency before ovulation on subsequent maturation and embryonic development (Tian & Diaz, 2013). On the contrary, bovine fully-grown oocyte from seems able to compensate for zinc absence in the in vitro culture medium.

Figure 1: Schematic illustration of experimental design to assess the role of zinc during a) oocyte in vitro culture of growing oocytes (IVCO) collected from small antral follicle, b) during in vitro maturation (IVM) of fully-grown oocytes collected from middle-size antral follicles and c) during in vitro embryo culture (IVC) after in vitro fertilization.



References

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